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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/677,545	10/02/2000	Schrems Martin	GR 99 P 4724	3079

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EXAMINER

NGUYEN, CUONG QUANG

ART UNIT	PAPER NUMBER
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2811

DATE MAILED: 12/01/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/677,545

Applicant(s)

MARTIN ET AL.

Examiner

Cuong Q Nguyen

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1 and 3-24 is/are pending in the application.
- 4a) Of the above claim(s) 10-19 is/are withdrawn from consideration.
- 5) ☒ Claim(s) 20-22 and 24 is/are allowed.
- 6) ☒ Claim(s) 1 and 3-9 is/are rejected.
- 7) ☒ Claim(s) 23 is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.
a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s) ____.
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) ____ 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 3 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Arnold (US 5,937,296) in view of Nishimura (US 4,949,138) and further in view of Economikos et al. (US 6,180,480).

Regarding claim 1, Arnold discloses a trench capacitor structure comprising: a substrate (12) having a trench formed therein, wherein the trench having an upper portion and a lower portion; an insulation collar (50, 58) formed in upper portion of the trench; a buried well (16) formed in the substrate, wherein the lower portion of the trench extending partly through the buried well; a capacitor dielectric layer (34, a silicon oxide or a silicon nitride layer) lining the lower and upper regions of the trench; and a conductive trench filling (32) formed in the trench. See Arnold's Fig.1.

Arnold does not teach that the capacitor dielectric layer (34) can be formed of tungsten oxide and the conductive trench filling formed of tungsten-containing material disposed in upper and lower regions of the trench.

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Nishimura discloses a capacitor structure comprising a capacitor dielectric layer (15) is formed of silicon oxide, silicon nitride or tungsten oxide. See Nishimura's Fig.4 and col.2, lines 22-68.

Economikos et al. discloses a trench capacitor structure comprising a tungsten-containing material (30, 56) filled an upper region and a lower regions of a trench to form a storage node of the trench capacitor. See Economikos et al.'s Fig.6.

It would have been obvious to one of ordinary skill in the art to form the capacitor dielectric layer of tungsten oxide instead of silicon nitride or silicon oxide as taught by Nishimura because these material are art recognized material for forming the capacitor dielectric layer and they are interchangeable. Moreover, one of ordinary skill in the art would have been motivated to do so because tungsten oxide has a very high dielectric constant comparing with silicon oxide or silicon nitride. It also would have been obvious to one of ordinary skill in the art to incorporate tungsten-containing filling material for forming the capacitor storage node as taught by Economikos et al. into Arnold's device in order to obtain a capacitor trench with completely filled conductive material. See Economikos et al.'s col.2, lines 23-30.

Regarding claim 3, the device formed by the combination of Arnold and Nishimura has capacitor dielectric layer of tungsten oxide which is the same material as claimed device. Therefore, the tungsten oxide capacitor dielectric layer in the device formed by the combination of Arnold and Nishimura inherently has a dielectric constant greater 50 as claimed.

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Regarding claim 9, as shown in Arnold's Fig.9, a vertical transistor formed in the trench.

Claims 4-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Arnold in view of Nishimura, Economikos et al. and further in view of Wallace et al. (US 6,277,681).

Arnold, Nishimura and Economikos et al. substantially teach all the limitations of claims 1, 3, and 9 as shown above but fails to teach that barrier layers formed between the capacitor dielectric layer and the capacitor electrodes.

Wallace et al. discloses a capacitor structure (col.1, lines 20-23) comprising silicon nitride barrier layer (13, 17) formed between the high dielectric constant layer (15) and conductive layers. See Wallace et al.'s Fig.2.

It would have been obvious to one of ordinary skill in the art to incorporate the barrier layers as taught by Wallace et al. into the device formed by the combination of Arnold, Nishimura and Economikos et al. in order to dopants in the conductive layers diffusing into the dielectric layer. See Wallace et al.'s col.3 lines 15-20.

Response to Arguments

2. Applicant's arguments with respect to claims 1, 3-9 have been considered but are not persuasive.

Applicants argue that Economikos et al. does not teach that the trench filling material is tungsten-containing material. In response, the device being formed by the combination of Arnold, Nishimura and Economikos et al. includes a tungsten-containing material in the trench as discussed above. It is noted that , the claimed language in

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claim 1 does not require the tungsten-containing material filling entirely the trench, so a portion of the trench having tungsten-containing material still meet the claimed language.

Allowable Subject Matter

3. Claim 23 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

4. Claims 20-22 and 24 are allowed.

5. The following is an examiner's statement of reasons for allowance: the combination of above references appears to be the closest prior art reference. However, this combination fails to teach the following: the trench is entirely filling of tungsten containing material (claim 23); an insulation layer disposed on a top surface of dielectric layer and extending from the upper end of barrier layer to upper end of insulation collar and dielectric layer (claim 20). Prior art of record fails to teach or suggest to incorporate these limitations into above references to arrive at the claimed device.

Conclusion

6. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not

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mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

7. Papers related to this application may be submitted to Technology center (TC) 2800 by facsimile transmission. Papers should be faxed to TC 2800 via the TC 2800 Fax center located in Crystal Plaza 4, room 4-C23. The faxing of such papers must conform with the notice published in the Official Gazette, 1096 OG 30 (November 15, 1989). The Group 2811 Fax Center number is (703) 872-9306. The Group 2811 Fax Center is to be used only for papers related to Group 2811 applications.

8. Any inquiry concerning this communication or any earlier communication from the Examiner should be directed to CUONG Q NGUYEN whose telephone number is (703) 308-1293. The Examiner is in the Office generally between the hours of 6:30 AM to 5:00 PM (Eastern Standard Time) Monday through Thursday.

9. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor Eddie Lee who can be reached on (703) 308-1690. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

10. Any inquiry of a general nature or relating to the status of this application should be directed to the Technology Center Receptionists whose telephone number is 308-0956.

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A handwritten signature in black ink, appearing to read 'Cuong Nguyen', with a stylized, cursive script.

Cuong Nguyen

Primary examiner

11/26/03